

FINAL REPORT
ON
CRITERIA FOR POTENTIAL WILDERNESS CAMPSITES
Supplement No. 32 to 12-11-204-3

Submitted to
Robert C. Lucas
Project Leader
Wilderness
USFS-INT

Perry J. Brown
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Colorado State University

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Colorado State University

conducted through the
Institute for the Study of Outdoor Recreation and Tourism
Utah State University

June, 1974

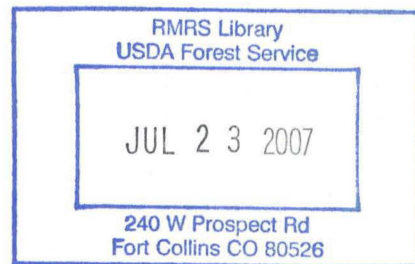
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CRITERIA FOR POTENTIAL WILDERNESS CAMPSITES

PROBLEM

The recreational use of wilderness areas is burgeoning. As recreational use increases in a physically finite system of wilderness locations, the wilderness manager is faced with the problem of determining what level of use is desirable in the context of visitor satisfaction and preservation of the resource. This general subject is discussed under the topic of recreational carrying capacity.

Recreational carrying capacity has two major components, human and resource. The human component deals generally with user satisfaction and is highly dependent upon the user's perception of the environment. The resource component deals with the ability of an area to physically provide recreational opportunities and with its ability to withstand use without being extensively damaged.

A basic assumption of this study is that it is desirable to maximize aggregate user satisfaction within the constraints of the Wilderness Act. Aggregate user satisfaction may be increased by providing a higher quality experience for a given number of people or by providing a given (but lower) quality experience for a greater number of people. The ability of a wilderness to provide camping opportunities is an important component of the maximization of aggregate visitor satisfaction. This is because all users, except day users, must camp in wilderness areas. The more suitable campsites a wilderness area has, the more people that can be accommodated or the greater the ability to disperse a given number of people and thus increase their feeling of solitude.

Before the camping opportunities of an area can be evaluated it is necessary to determine the factors which define physically suitable and desirable campsites. The study reported here was directed at providing information basic to determinations of the ability of a wilderness area to provide camping opportunities. The following objective guided this study.

Objective

To develop criteria for the identification and evaluation of camping opportunities in the Spanish Peaks Primitive Area.

These criteria relate both to the physical requirements for acceptable sites and to desirability and visitor satisfaction.

Study Area

The study reported here was made in the Spanish Peaks of Montana. The Peaks are located between the Gallatin and Madison Rivers southwest of Bozeman, Montana. They are adjacent to some heavy recreational use areas in south central Montana. This area was selected for study because information gathered there would complement data already gathered by the Forest Service on use and users in the area. Since the human and the resource components of carrying capacity are heavily inter-related, this work was conducted in the Spanish Peaks Primitive Area in order to develop as complete an understanding as possible of wilderness recreation in a given area. The area studied is the area proposed by the Forest Service as a wilderness area, an area slightly larger than the current primitive area. This was a reasonable area to study because it is likely that this will be the management unit in the future.

SCOPE

This study was limited to the area outlined above. The results are specific to this area and possibly may not be generalizeable to other wilderness areas.

The focus of this study was limited to the identification of criteria as outlined in the objective. The suitability of mapping these criteria was considered in the second year of the study.

The campsites considered during this study were summer sites. Fall sites, dominated by hunting parties, and winter sites were not considered except where obvious evidence of past use existed.

PROCEDURES

Background information

Prior to entering the Spanish Peaks Primitive Area as much information as possible was obtained which related to that area. Large scale maps of the area were obtained and permitted area familiarization before on-the-ground inspection.

The personnel of the Squaw Creek Ranger District were consulted and they provided information on campsite locations for parties with stock. These data were inspected and the information transferred to our study maps. The criteria used in establishing horse capacities for these sites were investigated. The impressions of the district people on where people camp and what campsite characteristics appear to be desirable to users were also sought. The district people were asked to identify outfitters operating within and familiar with the primitive area.

Outfitters were asked to locate on maps, as closely as possible, campsites which they used in the study area. They were also asked what they felt are the necessary and desirable characteristics of a campsite.

Campsite locations as determined in the Forest Service baseline study of the Spanish Peaks Primitive Area were also considered. This information helped identify the greatest potential for location of campsites within the study area and thus made field trips more efficient.

Observation within study area

Three field trips were taken into the Spanish Peaks: (1) July 5 to 9, 1972; (2) August 3 to 7, 1972; (3) August 8 to 10, 1973 (Figure 1). All these trips were within the general heavy use season for this area.

The first trip was made into several watersheds within the central and western portions of the area. The trip route was Spanish Creek Guard Station to Indian Ridge to Thompson Lake to Mirror Lake via Chilled Lakes and Summit Lake to Jerome Rock Lake via the Hermit Lake drainage to Spanish Creek Guard Station. The second trip was made into the western watersheds of the area. From Spanish Creek Guard Station we traveled to Roseita Lake (within the Jerome Rock area) to Brother Basin to Lake Solitude (back across Jerome Rock) to Spanish Lakes Basin to Spanish Creek Guard Station. The last trip was along a route which took us up Deer Creek to Deer Lake and then cross-country to the Cascade Lakes and then to Lava Lake ending at the trailhead leading to Lava Lake.

Campsites were evaluated by a check-list procedure. If evidence of a former campsite existed, a fire circle for instance, the evaluation was made immediately upon encountering the site. If a site was occupied, the nature of the party was noted and the desirability and satisfaction of the site was probed for in an informal discussion with the users. The campsite was later evaluated and documented in more detail when the site was unoccupied.

Figure 1. Spanish Peaks Primitive Area study trips

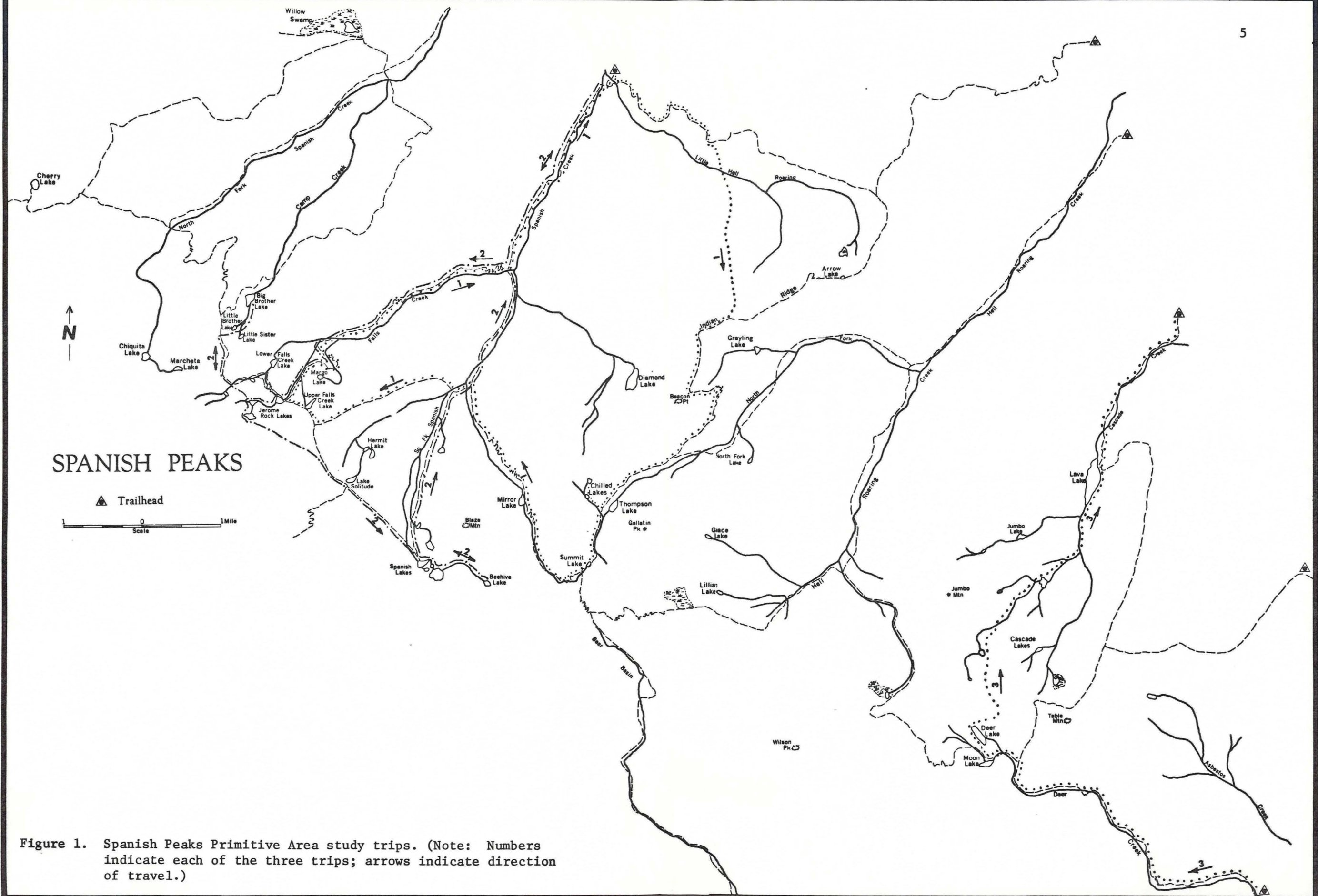


Figure 1. Spanish Peaks Primitive Area study trips. (Note: Numbers indicate each of the three trips; arrows indicate direction of travel.)

The check-list used in evaluating the sites included the following items which were recognized as criteria possibly associated with campsites in the Spanish Peaks:

1. Site identification number
2. Dimension of relatively level area surrounding firepit and the slope of this area
3. Distance from cooking area to lake or stream
4. Visibility of lake or stream
5. Distance from cooking area to firewood
6. Distance from cooking area to trail
7. Shade (morning or afternoon)
8. Type of vegetation on site (overstory, understory)
9. Soil moisture (dry, wet, boggy)
10. Rock outcrops
11. Elevation
12. Area of forage available
13. Distance to forage
14. Facilities provided (developments)
15. Mutual campsite visibility
16. Description of view from campsite
17. Special activities available near campsite
18. Other observations (impact estimate, note of artifacts and litter, audibility of running water, etc.)

When the site was occupied, the following information was recorded:

1. Type of party
 - a. Backpack
 - b. Horseback
 - c. Hikers with stock

2. Size of party
 - a. Number of people
 - b. Number of stock
3. Number of tents
4. User satisfaction with site
5. Site selection process
6. Evidence of previous site use
7. User description of ideal camping site

At the time of check-list evaluation of the site, color slides were taken to further document the site. Pictures were taken on the site itself and also of the 360° panoramic view from the site.

Data analysis

The items in the check-list were categorized. The size of areas were divided into 100 square foot categories and the distances into 50 foot categories. The percentage of sites in each category was plotted against the categories. Where appropriate, the cumulative percentage of sites included in each category was also plotted against the categories. The former graph indicates whether a certain distance or area category is favored among the categories considered. The latter graph indicates the percentage of sites that occur less than a given distance from a factor or that occupy less than a given area.

The comments of users on campsite desirability and satisfaction were compiled and tabulated. These comments were examined for possible influence on campsite selection and location.

The photographs of the view from each campsite were reviewed for possible common elements. This procedure involved showing to evaluators a series of slides depicting panoramic views at a number of campsites in

the Spanish Peaks Primitive Area. After each campsite panorama was shown, evaluators were given a brief time period in which to record their responses to the panorama. They were instructed to try to not allow varying numbers of slides within panoramas or the quality of the photography bias their evaluations.

For each evaluation they were instructed to imagine that they were camping at the site where the slides were taken and evaluate the scenery that could be seen from the site. They were to evaluate the scenery in the following two ways:

1. Rate each panorama, according to how pleasing they found the scene as a camper at the site, on a one to seven scale (seven extremely pleasing);
2. Identify the most striking features of the panorama by using one or two word descriptors like meadow, trees, lake, rocky ridge, etc.

These data were then tabulated and summarized to identify the sites with the most and the least pleasing views and to identify descriptors associated with these two classes. Descriptors were correlated with the quartile of sites most pleasing and to the quartile least pleasing.

Site factor validation

The significant site factors identified on the first field excursion were tested on a second observational field trip. Both occupied and unoccupied sites not observed on the first field trip were used in this test. A list of significant criteria was made from the data collected on the first field trip and from user comments. Each site encountered on the second trip was evaluated to determine whether or not it had characteristics which fit the list of criteria. The idea was to determine whether or not the actual sites had characteristics like those described by the criteria.

In addition to evaluating the sites against the significant criteria identified on the first field trip, each new site was characterized using all the characteristics measured on the first trip. These data were then used to supplement the first campsite inventory and make further analysis of the significance of each criterion.

The same procedure was used for checking criteria derived from the first two trips, after trip three. Trip three data were also combined with the data from the other trips in order to expand the criteria identification data base. Trip three was also used to field check mapping accuracy and a discussion of that procedure is provided later under the heading "Criteria Utilization".

CRITERIA: ALL SITES

The following data were derived from observation of 88 campsites located within the studied portions of the Spanish Peaks Primitive Area. For each site factor examined, data are reported for each of the three trips, the three trips combined, and the heavily impacted sites. Heavily impacted sites are presented separately because they may indicate which sites are most desirable. The heavy impact of a site implies heavy usage which in turn implies that the sites are desirable. This conclusion is warranted considering that alternative sites are usually available in the same area as the impacted sites. Thus, criteria associated with the impacted sites probably indicate the "best" sites. For the criteria "area of forage" and "distance to forage" obvious horse use sites are reported. Data are also reported for sites with and without obvious horse use for the site factors that differed considerably between the two classifications. The analysis of photographs of site panoramas is then presented. Finally, conclusions are drawn regarding important criteria.

Level area

For the 88 sites examined, dimension of level area varies considerably (Table 1). All areas measured were six percent slope or less; most were four percent or less. Data for the three trips indicate that little difference in size distribution of sites exists among the three areas covered. Therefore, the combined trip percentages reflect quite accurately the distribution for all trips. The combined data are presented graphically in Figure 2. For the heavily impacted sites the distribution was about the same.

Table 1. Percentage of sites for each dimension of level area class for Spanish Peaks Primitive Area campsites

Class in feet ²	Percentage					Cumulative Percentage				
	T1 ^a	T2 ^b	T3 ^c	AT ^d	IS ^e	T1 ^a	T2 ^b	T3 ^c	AT ^d	IS ^e
300-399	5	-	3	2	-	5	-	3	2	-
400-499	-	8	-	3	-	5	8	3	6	-
500-599	5	8	17	10	10	10	16	20	16	10
600-699	11	8	3	7	-	21	24	23	23	10
700-799	-	10	3	6	3	21	34	27	28	13
800-899	5	5	10	7	10	26	39	37	35	23
900-999	11	5	3	6	7	37	44	40	41	30
1000-1099	11	12	-	8	3	48	56	40	49	33
1100-1199	-	5	-	2	3	48	61	40	51	37
1200-1299	5	5	-	3	7	53	66	40	55	43
1300-1399	5	3	3	3	3	58	69	43	58	47
1400-1499	-	3	3	2	3	58	72	47	60	50
1500-1599	5	-	7	3	3	63	72	53	64	53
1700-1799	11	-	7	5	3	74	72	60	68	57
1900-1999	-	-	13	5	7	74	72	73	73	63
2000-2099	5	3	-	2	3	79	75	73	75	67
2200-2299	-	-	3	1	-	79	75	77	76	67
2500-2599	5	-	-	1	-	84	75	77	77	67
2700-2799	-	-	3	1	3	84	75	80	78	70
3000-3099	-	5	-	2	3	84	80	80	81	73
3100-3199	-	3	-	1	-	84	83	80	82	73
3900-3999	5	-	-	1	-	89	83	80	83	73
5300-5399	-	-	3	1	3	89	83	83	84	77
5400-5499	-	-	7	2	7	89	83	90	86	83
5500-5599	-	5	-	2	3	89	88	90	89	87
7200-7299	-	-	3	1	3	89	88	93	90	90
7500-7599	5	-	-	1	3	94	88	93	91	93
9200-9299	-	-	3	1	-	94	88	97	92	93
>9900	5	12	3	8	7	99	100	100	100	100

^aTrip 1, n=19

^bTrip 2, n=39

^cTrip 3, n=30

^dAll trips, n=88

^eImpacted sites, n=30

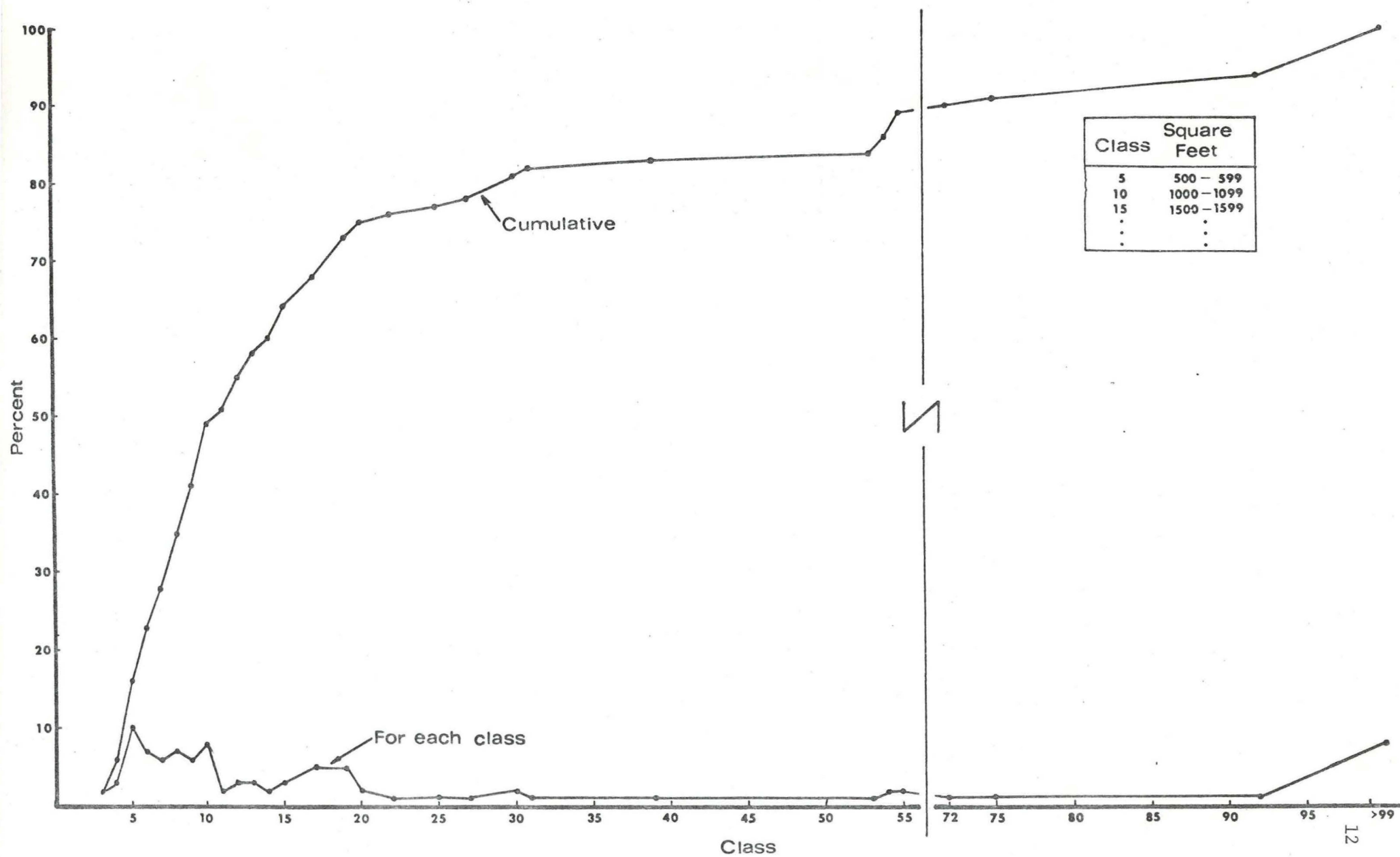


Figure 2. Percentage of sites for each dimension of land area class for Spanish Peaks Primitive Area campsites.

One reason that considerable variation in site dimension of level area exists is that dimension is related to party size and type. Larger parties and horse parties need larger areas.

Distance to water

The distance from campsite fire areas to a lake or stream is reflected in Table 2. Most sites occur quite close to a water source. The cumulative percentage portion of Table 2 indicates that over 96 percent of all sites occur within 300 feet of water and that all sites occur within 500 feet of water. These data are graphically presented in Figure 3. Impacted sites have approximately the same distribution as all sites.

Visibility of water

From 94 percent of all campsites encountered one can see a lake or stream (Table 3). The data were nearly the same for sites found on all trips. Heavily impacted sites had nearly the same distribution as sites in general. It is clear that lake views seem more important than stream views with all heavily impacted sites having lake visible, if water was visible from the site.

Distance to firewood

Campsites in the Spanish Peaks are located relatively close to firewood (Table 4). Nearly all, 97 percent, of the sites were within 300 feet of firewood. Heavily impacted sites are disproportionately farther from firewood when compared to all sites in the less than 150 feet class. This increased distance may reflect use and past gathering of firewood. The combined data for all trips is presented in graph form in Figure 4.

Even though all sites were relatively close to firewood, it does not seem mandatory that they be so close because many people carry camp stoves.

Sites can be located some distance from firewood and still be useable, but they may not be as desirable as sites close to firewood.

Table 2. Percentage of sites for each distance class to water for Spanish Peaks Primitive Area campsites.

Class in feet	Percentage					Cumulative Percentage				
	T1 ^a	T2 ^b	T3 ^c	AT ^d	IS ^e	T1 ^a	T2 ^b	T3 ^c	AT ^d	IS ^e
0-52	37	41	53	44	50	37	41	53	44	50
51-100	--	28	17	18	17	37	69	70	63	67
101-150	16	10	20	15	23	53	79	90	77	90
151-200	16	5	7	8	3	69	84	97	85	93
201-250	--	3	--	1	--	69	87	--	86	93
251-300	26	5	3	9	3	95	92	100	96	97
351-400	5	3	--	2	--	100	95	--	98	97
451-500	--	5	--	2	3	100	100	--	100	100

^aTrip 1, n=19

^bTrip 2, n=39

^cTrip 3, n=30

^dAll trips, n=88

^eImpacted sites, n=30

Table 3. Percentage of sites from which water is visible for Spanish Peaks Primitive Area campsites.

Type of water	Percentage				Impacted Sites (n=30)
	Trip 1 (n=19)	Trip 2 (n=39)	Trip 3 (n=30)	All trips (n=88)	
Lake only	68	67	67	67	70
Stream only	11	5	--	4	--
Lake and stream	16	20	30	23	20
No water visible	5	8	3	6	10

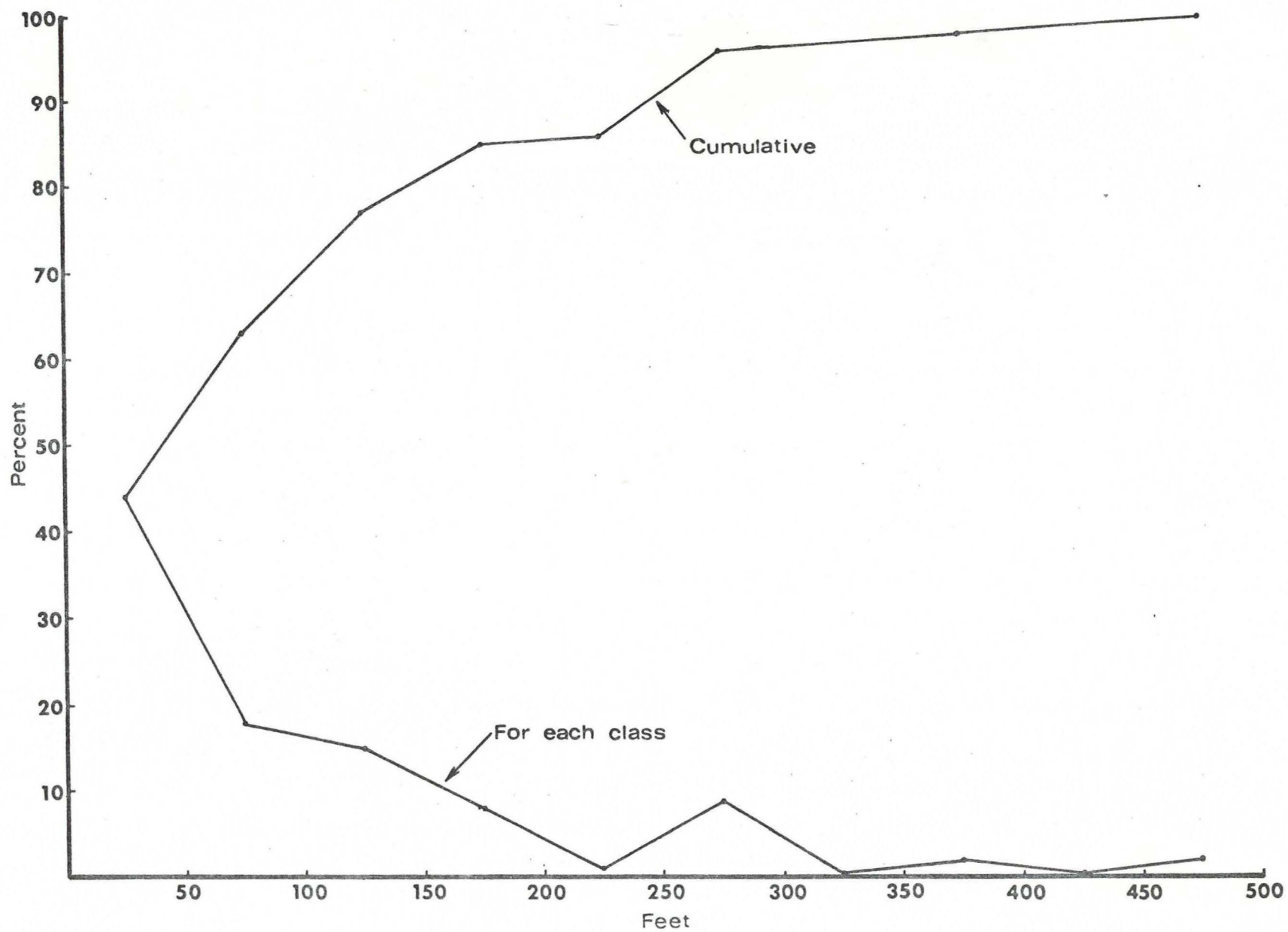


Figure 3. Percentage of sites for each distance class to water for Spanish Peaks Primitive area campsites.

Table 4. Percentage of sites for each distance to firewood class for Spanish Peaks Primitive Area campsites.

Class in feet	Percentage					Cumulative Percentage				
	T1 ^a	T2 ^b	T3 ^c	AT ^d	IS ^e	T1 ^a	T2 ^b	T3 ^c	AT ^d	IS ^e
0-50	26	26	10	21	17	26	25	10	21	17
51-100	42	26	23	28	17	68	51	33	49	33
101-150	11	18	30	21	17	79	69	63	69	50
151-200	16	10	13	13	20	95	80	77	82	70
201-250	--	3	17	7	13	95	82	93	89	83
251-300	5	13	3	8	10	100	95	97	97	93
351-400	--	3	3	2	7	100	97	100	99	100
>700	--	3	--	1	--	100	100	100	100	100

^aTrip 1, n=19

^bTrip 2, n=39

^cTrip 3, n=30

^dAll trips, n=88

^eImpacted sites, n=30

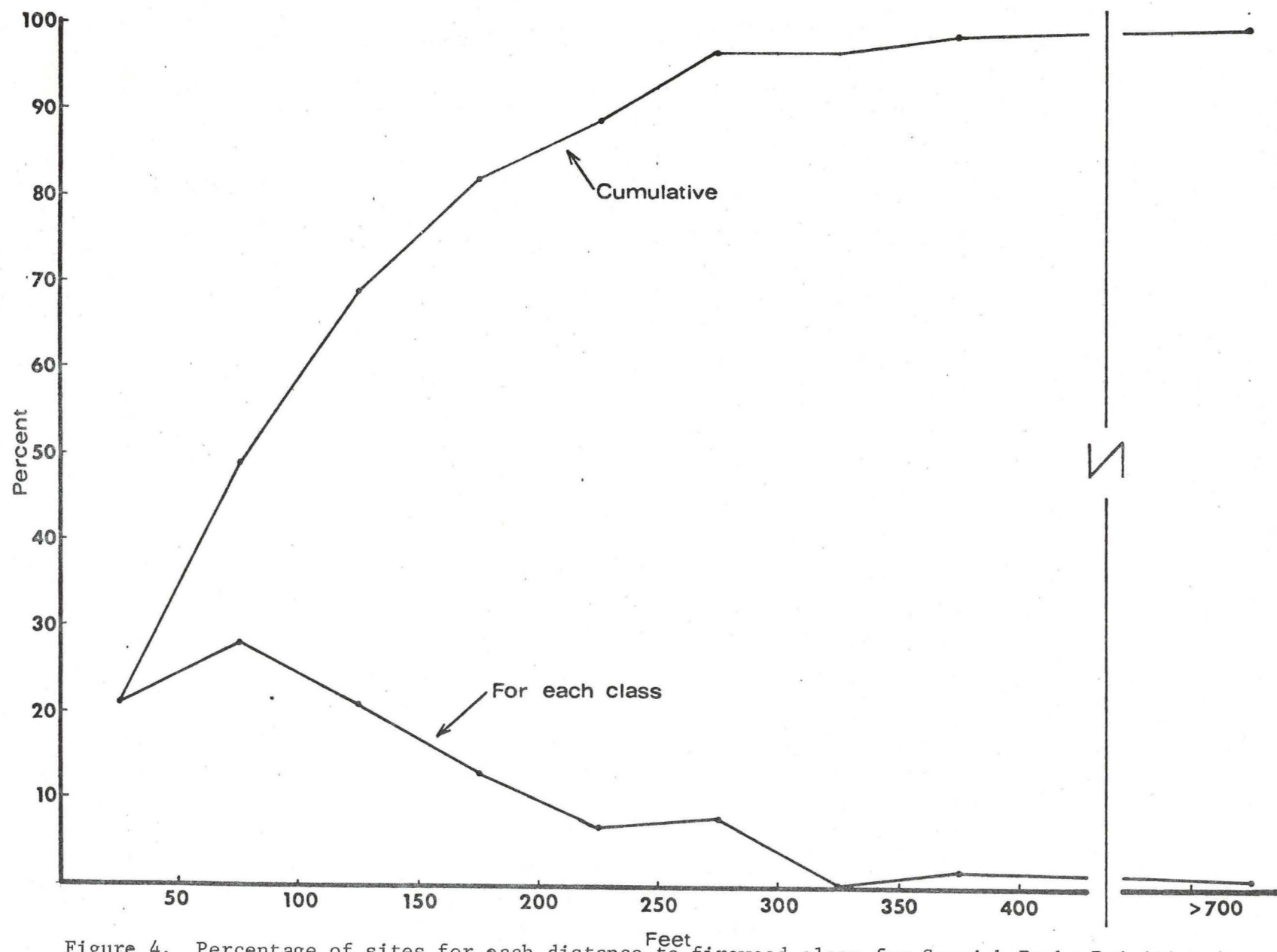


Figure 4. Percentage of sites for each distance to firewood class for Spanish Peaks Primitive Area campsites.

Distance to trail

The distance to primary trails from campsite fire areas is shown in Table 5 and Figure 5. More than half of all sites encountered were within 300 feet of a primary trail. Sites were found farther than 700 feet from a primary trail, but these sites were likely to be on or near a secondary trail around a lake. Impacted sites were over represented in their proximity to a primary trail as compared to all sites investigated.

Shade

The percentage of sites having morning only, afternoon only, both morning and afternoon, and no shade at all is shown in Table 6. About 80 percent of all sites had shade of some type. Heavily impacted sites were more likely to have both morning and afternoon shade, 77 percent of the impacted sites fell in this category. It appears that while shade is not absolutely necessary for a site, it is generally desirable.

Overstory vegetation

Overstory vegetation data correlate quite closely, as one would expect, with the data for shade over sites. Conifers dominated the overstory vegetation where it occurred over sites (Table 7). Of all the sites examined, 80 percent had overstory vegetation while 90 percent of the heavily impacted sites had overstory vegetation. It appears that overstory vegetation is not absolutely necessary, but it is desirable.

Understory vegetation

Seventy-five percent of all sites observed had understory or ground vegetation (Table 8). However, only 47 percent of the heavily impacted sites had ground vegetation. This should be expected because the impaction of ground vegetation is a cue for identifying site impact. While under-

Table 5. Percentage of sites for each distance class to a primary trail for Spanish Peaks Primitive Area campsites.

Class in feet	Percentage					Cumulative Percentage				
	T1 ^a	T2 ^b	T3 ^c	AT ^d	IS ^e	T1 ^a	T2 ^b	T3 ^c	AT ^d	IS ^e
0-50	32	33	20	28	40	32	33	20	28	40
51-100	16	8	10	10	10	47	41	30	39	50
101-150	11	--	--	2	3	58	41	30	41	53
151-200	5	3	10	6	7	63	44	40	47	60
201-250	5	5	10	7	10	68	49	50	53	70
251-300	--	10	7	7	10	68	59	57	60	80
301-350	5	--	7	3	--	74	59	63	64	80
351-400	5	3	3	3	7	79	62	67	67	87
451-500	11	3	3	5	--	90	64	70	72	87
501-550	--	3	--	1	--	90	67	70	73	87
551-600	--	3	3	2	--	90	69	73	75	87
651-700	--	3	--	1	--	90	72	73	76	87
>700	11	28	27	24	13	100	100	100	100	100

^aTrip 1, n=19^bTrip 2, n=39^cTrip 3, n=30^dAll trips, n=88^eImpacted sites, n=30

Table 6. Percentage of sites having shade for Spanish Peaks Primitive Area campsites.

Type of Shade	Percentage				
	Trip 1 (n=19)	Trip 2 (n=39)	Trip 3 (n=30)	All Trips (n=88)	Impacted Sites (n=30)
Morning only	--	8	10	7	7
Afternoon only	11	15	13	14	7
Morning and afternoon	42	54	73	58	77
No shade	47	23	3	22	10

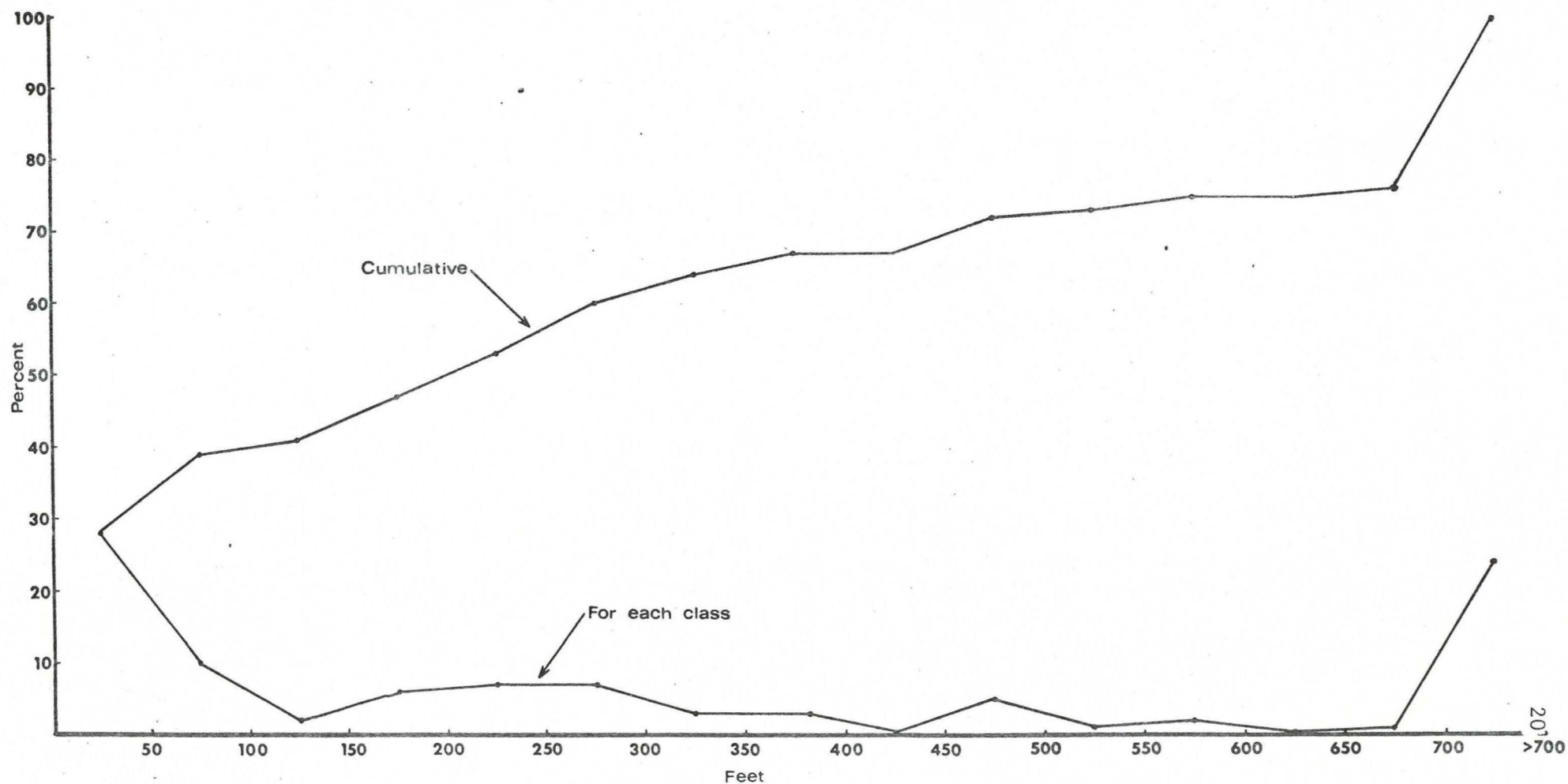


Figure 5. Percentage of sites for each distance to trail class for Spanish Peaks Primitive Area campsites.

Table 7. Percentage of sites having overstory vegetation for Spanish Peaks Primitive Area campsites.

Type of Vegetation	Trip 1 (n=19)	Trip 2 (n=39)	Percentage		Impacted Sites (n=30)
			Trip 3 (n=30)	All Trips (n=88)	
Conifer	68	74	93	80	90
No vegetation	32	26	7	20	10

Table 8. Percentage of sites having understory vegetation for Spanish Peaks Primitive Area campsites.

Type of Vegetation	Trip 1 (n=19)	Trip 2 (n=39)	Percentage		Impacted Sites (n=30)
			Trip 3 (n=30)	All Trips (n=88)	
Grass/Forbs	84	77	67	75	47
No vegetation	16	23	33	25	53

story vegetation might be nice to have on campsites, it does not appear to be a major factor in desirability of sites.

Soil moisture

As one might expect, whether or not a site is dry appears to be quite important in determining its desirability. Table 9 shows the percentage of sites which were dry, boggy, and wet. Nearly all sites were dry and all of the heavily impacted sites were dry. It appeared during the field inventories that all of the sites would be dry by the fall hunting season.

Rock outcrops

Whether or not there are rock outcrops on a site seems unimportant to site desirability although the percentage of sites in a given class does seem to be inversely proportional to the number of outcrops in that class. Rock outcrops were found on 67 percent of all sites observed. Rock outcrops occur on 53 percent of the heavily impacted sites (Table 10).

Elevation

The elevation at which sites occur is shown in Table 11. Given that most sites occur near water, the data reflect the elevations of the lakes that were investigated in the Spanish Peaks Primitive Area. The elevation class and the lakes which predominate in that class for the four largest percentages of the combined trips are: 7100-7199 feet, Lava Lake; 8900-8999 feet, Spanish Lakes; 9000-9099 feet, Spanish Lakes, Thompson Lake, and Moon Lake; 9400-9499 feet, Deer Lake.

Area of available forage

About 70 percent of the sites encountered had some forage available for horses (Table 12). The amount of forage varied considerably among all

Table 9. Percentage of sites in dry, boggy and wet classes for Spanish Peaks Primitive Area campsites.

Degree of Moisture	Percentage				Impacted Sites (n=30)
	Trip 1 (n=19)	Trip 2 (n=39)	Trip 3 (n=30)	All trips (n=88)	
Dry	95	97	100	98	100
Boggy	--	3	--	1	--
Wet	5	--	--	1	--

Table 10. Percentage of sites having none, few, several, and many rock outcrops for Spanish Peaks Primitive Area campsites.

Class	Percentage				Impacted Sites (n=30)
	Trip 1 (n=19)	Trip 2 (n=39)	Trip 3 (n=30)	All trips (n=88)	
None	37	31	33	33	47
Few	37	51	40	44	33
Several	10	15	17	15	13
Many	16	3	10	8	7

Table 11. Percentage of sites for each elevation class for the Spanish Peaks Primitive Area campsites.

Elevation in feet	Percentage				Impacted Sites (n=30)
	Trip 1 (n=19)	Trip 2 (n=39)	Trip 3 (n=30)	All trips (n=88)	
6400-6499	--	3	--	1	3
6900-6999	--	2	--	1	3
7100-7199	--	--	47	16	33
8200-8299	16	--	--	3	7
8300-8399	11	--	--	2	3
8400-8499	--	10	--	5	7
8700-8799	--	3	--	1	--
8800-8899	26	5	--	8	13
8900-8999	--	46	3	22	7
9000-9099	37	26	17	25	13
9200-9299	--	--	3	1	--
9400-9499	5	2	30	13	10
9500-9599	5	--	--	1	--
9700-9799	--	3	--	1	--

Table 12. Percentage of sites for each area of forage available class for Spanish Peaks Primitive Area campsites.

Area in Acres	Percentage				Impacted Sites (n=30)	Sites with obvious horse use (n=26)
	Trip 1 (n=19)	Trip 2 (n=39)	Trip 3 (n=30)	All trips (n=88)		
None	5	31	50	32	37	15
<1	16	15	--	10	7	15
1-2	5	20	20	17	17	15
3-4	32	13	30	23	10	30
5-6	26	3	--	7	10	8
7-8	16	18	--	11	20	15

sites with the heavily impacted sites having about the same distribution. Trip 3 sites typically did not have as much forage available as was found on Trips 1 and 2. Sites with obvious horse use have proportionately fewer sites without forage in comparison to all sites. It appears that it is not absolutely necessary to have available forage, but such a condition seems quite desirable for sites used by horse use parties.

Distance to forage

Table 13 contains data relative to distance to forage for the sites for which forage was available. About 80 percent of these sites had some forage available within 300 feet. Impacted sites and sites with obvious horse use have a slight tendency to have forage closer, compared to all sites.

Facility developments

A variety of facility developments were encountered at the campsites observed (Table 14). Due to the way campsites were identified (looking for firerings or other evidence of use), it is not surprising that most sites had firepits. It is somewhat interesting to note, however, that a surprisingly large proportion of sites have log benches or stools. Impacted sites had as great or greater percentage of development in each class when compared to all sites. This is not unexpected because this type of development suggests impact. While developments do not represent criteria for identifying potential sites one might suspect that sites for which modification is easy are most desirable. Modification of this type is, of course, inconsistent with the goals of the Wilderness Act.

Mutual campsite visibility

More than 60 percent of all campsites have at least one other campsite visible from them (Table 15). The heavily impacted sites had about

Table 13. Percentage of sites which have forage available for each distance to forage class for Spanish Peaks Primitive Area campsites.

Distance in feet	Percentage				Impacted Sites (n=30)	Site with obvious horse use (n=26)
	Trip 1 (n=19)	Trip 2 (n=39)	Trip 3 (n=30)	All Trips (n=88)		
0-300	83	70	100	82	90	86
301-1500	6	30	--	15	5	9
1500-2640	11	--	--	3	5	5

Table 14. Percentage of sites having different kinds of facility development for Spanish Peaks Primitive Area campsites.

Development	Trip 1 (n=19)	Trip 2 (n=39)	Percentage		Impacted Sites (n=30)
			Trip 3 (n=30)	All trips (n=88)	
Firepit	90	97	100	97	97
Benches or Stools	48	41	27	38	50
Nails	16	5	13	10	23
Bucket or Pail	10	8	3	7	7
Hand leveled tent area	5	5	7	6	17
Grille	10	8	--	6	7
Gathered or cut firewood	10	8	3	7	7
Picket pins or hitching racks	--	15	10	10	13
Cut poles	--	--	20	7	13

Table 15. Percentage of sites having other sites visible from them for Spanish Peaks Primitive Area campsites.

Number of Sites	Trip 1 (n=19)	Trip 2 (n=39)	Percentage		Impacted Sites (n=30)
			Trip 3 (n=30)	All trips (n=88)	
0	47	36	30	36	37
1	21	31	33	30	33
2	5	13	20	14	20
3	16	13	7	11	3
4	11	--	3	3	--
5	--	2	7	3	7
6	--	5	--	2	--

the same distribution as all sites for mutual campsite visibility. The data appear to suggest that if people are indeed sensitive to camping within sight of another party the actual number of campsites available is considerably less than the total number of sites found. The maximum number of sites not mutually visible is discussed under "Location of sites."

View from site

The features that can be seen from sites most often were lakes and rocky ridges (Table 16). Few other features were frequently recorded. Features were screened about a third of the time by trees close to the site.

Availability of fishing

The opportunity for fishing was often associated with sites (Table 17). One would expect this since most sites were located near lakes and streams. Whether or not fishing opportunity is important for site desirability is not known. However, because many fishermen utilize the Spanish Peaks, one would expect it to be of importance.

Other observations

Several observations other than those detailed above were made for the sites. Evidence of horse use, audibility of a stream or waterfall, and heavy impact of sites were the most frequent observations (Table 18). These factors are not criteria for the identification of campsites but are factors on which sites can be grouped.

Occupied sites

Too few occupied sites were encountered to report meaningful data.

Table 16. Percentage of sites having different view features for Spanish Peaks Primitive Area campsites.

Features or Scenes	Trip 1 (n=19)	Trip 3 (n=39)	Percentage		Impacted Sites (n=30)
			Trip 3 (n=30)	All trips (n=88)	
Rocky ridge or cliffs	58	72	60	65	60
Waterfall	10	3	--	3	3
Snowfields	37	18	--	16	17
Peaks	10	13	--	8	7
Cirque	10	--	--	2	--
Lake	79	41	57	55	67
Trees	5	15	27	17	17
Marsh	10	5	7	7	10
Meadow	16	15	--	10	13
Talsu	--	15	13	11	7
Stream	10	5	3	6	--
Basin	16	8	--	7	13
Rock outcropping	10	5	--	5	--
Partially screened features	21	28	53	35	50
A feature across lake visible	16	44	20	30	20
Rocky or grassy slopes	16	5	--	6	3
Forested ridge	--	--	57	19	40
Open vista	--	--	--	1	--

Table 17. Percentage of sites having fishing available for Spanish Peaks Primitive Area campsites.

Availability	Trip 1 (n=19)	Trip 2 (n=39)	Percentage		Impacted Sites (n=30)
			Trip 3 (n=30)	All trips (n=88)	
Yes	90	92	100	94	90
No	10	8	--	6	10

Table 18. Percentage of sites having selected observed features for Spanish Peaks Primitive Area campsites.

Features	Trip 1 (n=19)	Trip 2 (n=39)	Percentage		Impacted Sites (n=30)
			Trip 3 (n=30)	All trips (n=88)	
Heavily impacted	32	20	54	34	100
Horse use obvious	37	31	24	30	47
Audible stream or waterfall	32	33	17	27	23
Site exposed	21	--	--	5	3
Littered	16	10	--	8	10
Lightly used	--	18	27	17	--
Moderate impact	--	--	10	3	--

CRITERIA: HORSE SITES

In an attempt to identify criteria associated with horse party use of sites those with obvious horse use were compared with the sites that did not have obvious horse use. It is possible that some of the sites identified as not having obvious horse use might have been used by horse parties in the past, but no evidence of use was obvious. However, this number of possibly misidentified sites is probably small. All criteria were examined in comparing the sites with and without obvious horse use. Those criteria in which a noticeable difference existed between the two classifications are presented in tabular form below. The data show a noticeable difference between the two classifications in dimension of level area, distance to firewood, distance to primary trail, area of forage available, and facility development.

Level area

Table 19 and Figure 6 present a comparison of sites by dimension of level area of the sites. Sites with obvious horse use are generally bigger than other sites as would be expected. Ninety percent of the sites without obvious horse use had an area less than 2600 square feet while the corresponding percent for sites with obvious horse use was 50 percent. Only 20 percent of the obvious horse use sites have an area less than 1000 square feet; 50 percent of the other sites fit in this classification, however.

Distance to firewood

Sites with obvious horse use do not have firewood as close to them in comparison with other sites (Table 20 and Figure 7). Firewood may not be available either because of past heavy usage at horse sites or because

Table 19. Percentage of sites for each dimension of level area class for Spanish Peaks Primitive Area campsites with and without obvious horse use.

Class in feet	Percentage		Cumulative Percentage	
	With obvious horse use (n=26)	Without obvious horse use (n=62)	With obvious horse use (n=26)	Without obvious horse use (n=62)
300-399	4	2	4	2
400-499	-	5	4	7
500-599	-	15	4	21
600-699	8	7	12	27
700-799	-	8	12	36
800-899	4	8	15	44
900-999	4	7	19	50
1000-1099	-	11	19	61
1100-1199	-	3	19	65
1200-1299	8	2	27	66
1300-1399	4	3	31	69
1400-1499	-	3	31	73
1500-1599	-	5	31	77
1700-1799	8	3	39	81
1900-1999	4	5	42	86
2000-2099	4	2	46	87
2200-2299	-	2	46	89
2500-2599	-	2	46	90
2700-2799	4	-	50	90
3000-3099	4	2	54	92
3100-3199	4	-	58	92
3900-3999	4	-	62	92
5300-5399	4	-	65	92
5400-5499	8	-	73	92
5500-5599	8	-	81	92
7200-7299	4	-	85	92
7500-7599	-	2	85	94
9200-9299	-	2	85	95
≥9900	15	5	100	100

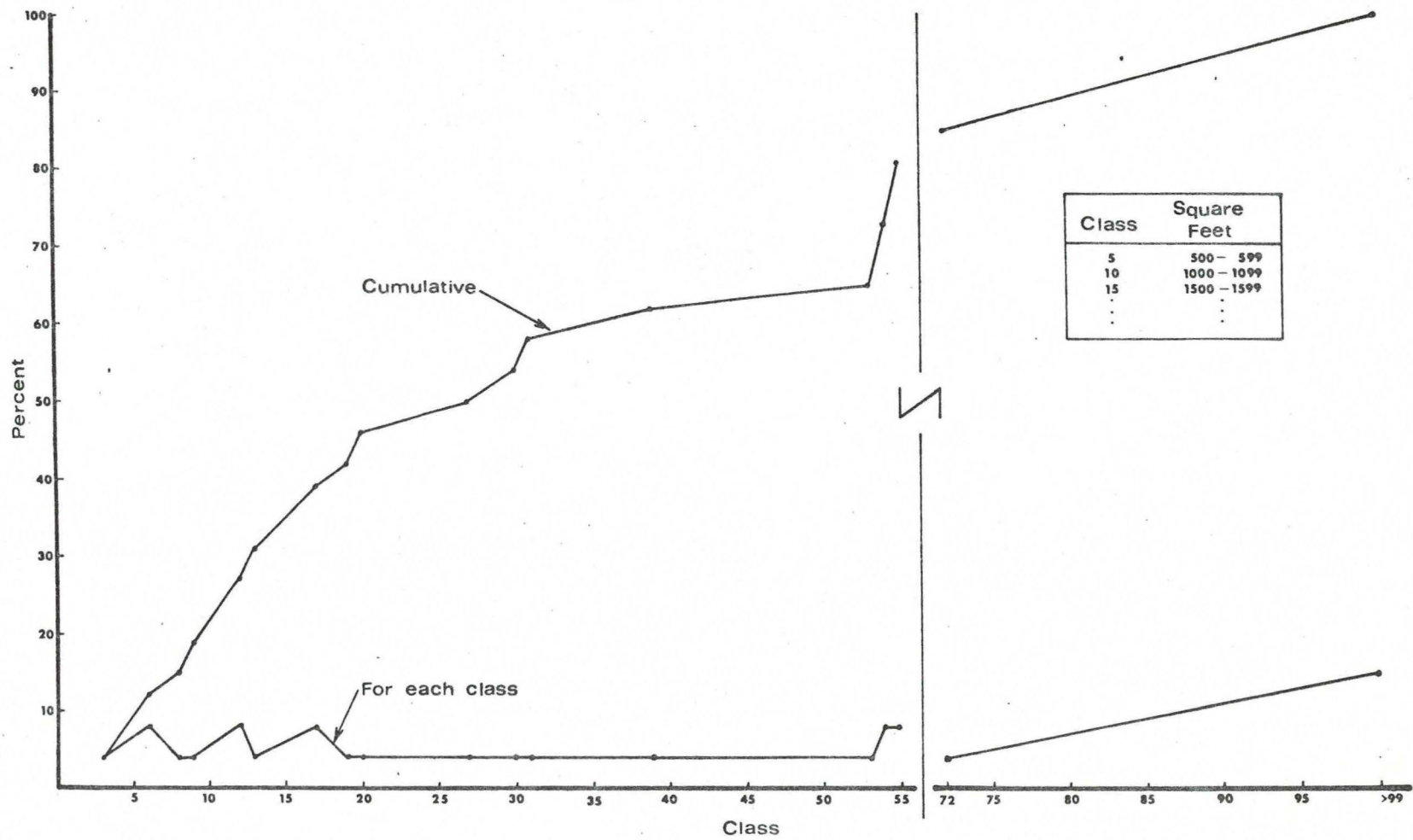


Figure 6. Percentage of sites for each dimension of land area class for Spanish Peaks Primitive Area campsites with obvious horse use.

Table 20. Percentage of sites for each distance to firewood class for Spanish Peaks Primitive Area campsites with and without obvious horse use.

Class in feet	Percentage		Cumulative Percentage	
	With obvious horse use (n=26)	Without obvious horse use (n=62)	With obvious horse use (n=26)	Without obvious horse use (n=62)
0-50	8	26	8	26
51-100	35	26	42	52
101-150	15	23	58	74
151-200	4	16	62	90
201-250	19	2	81	92
251-300	12	7	92	98
351-400	8	--	100	98
>700	--	2	100	100

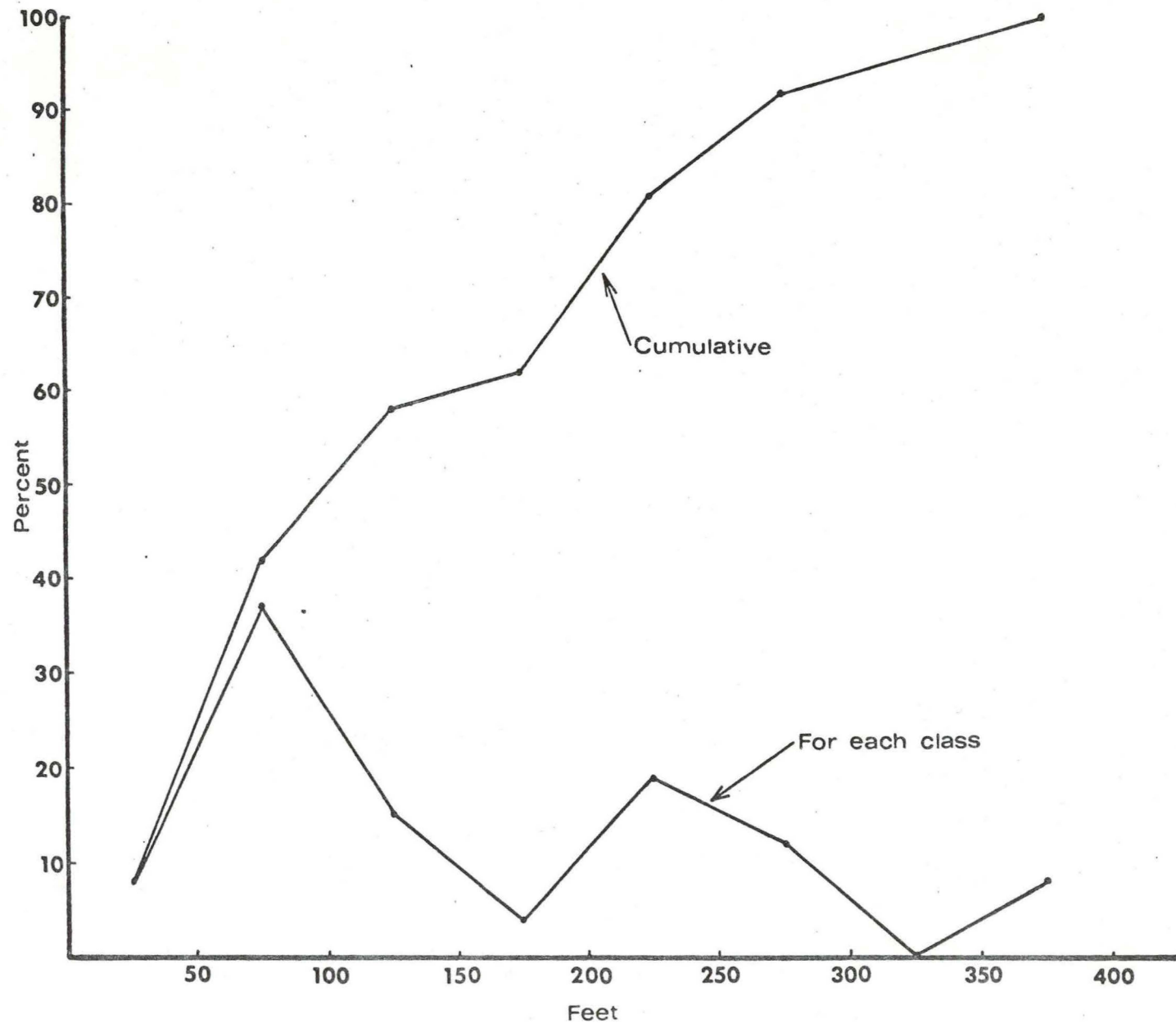


Figure 7. Percentage of sites for each sitance to firewood class for Spanish Peaks Primitive Area campsites with obvious horse use.

it was not natively available. These possibilities were not distinguished in our analysis.

Distance to trail

The percentages presented in Table 21 and Figure 8 indicate that sites with obvious horse use generally occur closer to a primary trail than other sites. This may indicate that horse parties are less likely to venture off the trail to find camping areas.

Area of forage

Forage availability is closely related to sites with obvious horse use. Table 22 presents the percentages in each area of forage class for the two classifications. Forty percent of the sites without obvious horse use did not have forage available to them. Only fifteen percent of the sites with obvious horse use did not have forage available.

Facility development

Percentages relevant to facility developments for sites with and without obvious horse use are presented in Table 23. Sites with obvious horse use tend to be more developed than other sites. Benches and stools, nails, hand leveled tent areas, cut poles, and, of course, picket pins or hitching racks are all disproportionately over-represented in sites with obvious horse use.

Table 21. Percentage of sites for each distance class to a primary trail for Spanish Peaks Primitive Area campsites with and without obvious horse use.

Class in feet	Percentage		Cumulative Percentage	
	With obvious horse use (n=26)	Without obvious horse use (n=62)	With obvious horse use (n=26)	Without obvious horse use (n=62)
0-50	42	23	42	23
51-100	8	11	50	34
101-150	4	2	54	36
151-200	8	5	62	40
201-250	8	7	69	47
251-300	4	8	73	55
301-350	--	5	73	60
351-400	12	--	85	60
451-500	--	6	85	66
501-550	--	2	85	68
551-600	4	2	89	69
651-700	--	2	89	71
>700	12	29	100	100

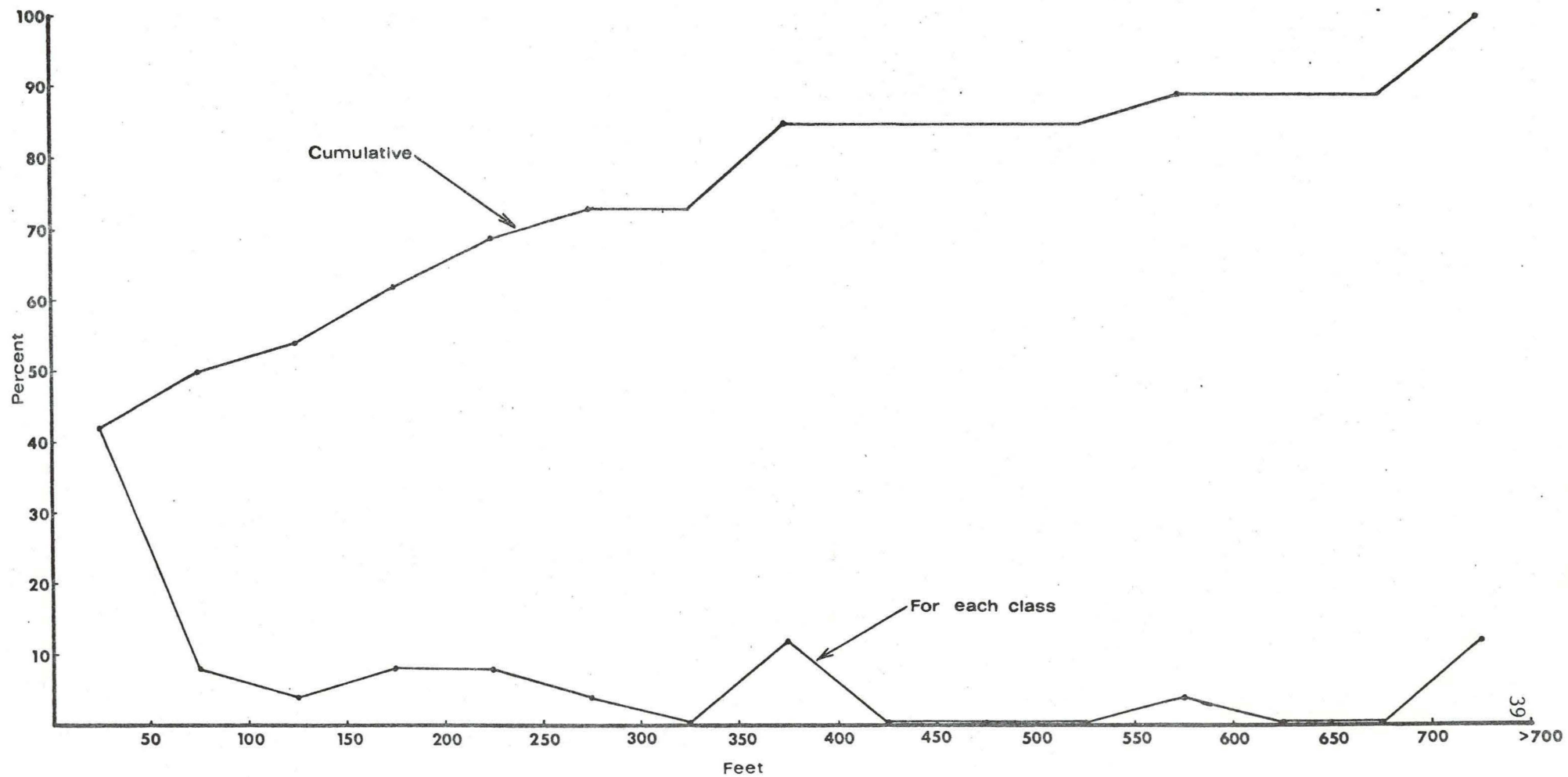


Figure 8. Percentage of sites for each distance to trail calss for Spanish Peaks Primitive Area campsites with obvious horse use.

Table 22. Percentage of sites for each forage class for Spanish Peaks Primitive Area campsites with and without obvious horse use.

Area in acres	Percentage	
	With obvious horse use (n=26)	Without obvious horse use (n=62)
None	15	39
< 1	15	8
1-2	15	18
3-4	31	19
5-6	8	7
7-8	15	10

Table 23. Percentage of sites having different kinds of facility development for Spanish Peaks Primitive Area campsites with and without obvious horse use.

Development	Percentage	
	With obvious horse use (n=26)	Without obvious horse use (n=62)
Firepit	96	97
Benches or stools	58	29
Nails	31	2
Bucket or pail	4	8
Hand leveled tent area	15	2
Grille	8	5
Gathered or cut firewood	4	8
Picket pins or hitching rack	31	2
Cut poles	15	3

IMPORTANT CRITERIA

All Sites

The data reveal that certain factors are strongly associated with the existence of campsites. Based upon consideration of all data plus those specifically associated with heavily impacted sites it appears that two lists of criteria can be generated: best sites and other sites.

Best sites. Best sites can be characterized as having a level area (4 percent or less) of at least 500 square feet for a two person party. They should be within 300 feet of water and there should be a lake visible from them. Other characteristics are that they are within 300 feet of firewood, 700 feet of a main or primary trail, dry, have morning and afternoon shade provided by overstory vegetation, have a view of water, ridges and peaks, and have fishing available nearby.

Acceptable sites. Sites are sometimes found with characteristics differing from those of the best sites. Reasonable characteristics are having a level area (4 percent or less) of at least 400 square feet for a two person party and being within 500 feet of water. Visibility of either a stream or lake is desirable. Sites other than the best sites should be within 750 feet of firewood and be dry.

Horse Use Sites

The data from the obvious horse use sites suggest a list of criteria desirable in delineating the sites most capable of supporting horse use. The better horse use sites can be characterized as having a level area (4 percent or less) of at least 800 square feet. They should be within 700 feet of a main or primary trail and should have forage available within 300 feet.

Functional Camping Area

To identify the area of a wilderness functionally capable of producing camping opportunities the following criteria need to be examined and met for each campsite.

1. A minimum of 400 square feet of level area(4 percent slope or less)
2. Within 500 feet of water
3. Visibility of lake or stream
4. Within 750 feet of firewood (this can be ignored where use of campstoves is likely or mandatory)
5. Dry

Once the area of functionality has been identified, individual sites can be classed as acceptable, highly desirable, or better horse use sites based upon the factor associations given above for each type. From this procedure one would know both the total number of sites available plus the sites most likely to be utilized.

CRITERIA UTILIZATION

Given the factors which define physically suitable and desirable campsites, it is possible to evaluate an area's camping opportunities. One way of using the above criteria is to make on-site inspection of the Spanish Peaks area and evaluate the potential camping opportunities for the inspected area in addition to the existing campsites. Another technique for inspecting the area is possible, however, by using aerial photographs. The technique and accuracy of evaluating camping opportunities from aerial photographs is described below. The technique reported below was developed in the Bridger Wilderness, Wyoming (Schomaker, 1973).

Mapping

Technique. The technique of identifying camping opportunities from aerial photographs consists, basically, of locating and mapping the criteria associated with the functional camping area on an overlay of a base map. Sites which possess the five criteria outlined above are mapped as potential campsites. In this study both black and white and color aerial photographs, scale 1:15,840, were examined for the area covered on Trip 3. U.S. Department of Agriculture, Forest Service, timber inventory maps (2 inches = 1 mile) were used as base maps. Distances were measured using a bar type micrometer wedge with lines of 0.0002 foot increments. A crown diameter scale, with dot size expressed in thousandths of an inch, was used to estimate the area of level sites. In evaluating the technique in the Spanish Peaks Primitive Area only sites close to lake water were considered.

The technique thus consisted of examining the land within 500 feet of a lake for sites which consisted of at least 400 square feet of dry

area of 4 percent slope or less. If the site satisfied these criteria, the potential site was mapped, and it was noted whether or not firewood was available and if water was visible from the site.

Accuracy. Two measures of mapping accuracy are necessary to evaluate the technique. The first measure indicates the percentage of sites correctly identified. This percentage is calculated by dividing the number of sites correctly identified from air photos by the actual number of suitable sites determined by on-site inspection. The second measure indicates the percentage of sites incorrectly identified. That is, sites which were identified as suitable from air photos, but were found unsuitable by on-site inspection. This percentage is calculated by dividing the number of unsuitable sites by the number of photo-identified campsites found suitable by on-the-ground inspection.

Table 24 shows a classification of sites for the inspected area on Trip 3. The percentage of sites correctly identified (15 to 37) is 41 percent. The percentage of sites incorrectly identified (2 to 15) is 13 percent. The percentage of sites correctly identified is low compared to our previous work in the Bridger Wilderness, Wyoming (Schomaker, 1973). In the Bridger study 87.5 percent of the sites were correctly identified and 6.7 percent were incorrectly identified.

The close grouping of some campsites accounts for some of the decreased accuracy in the Spanish Peaks. In certain instances an area interpreted from aerial photographs as capable of supporting camping was found to contain more than one actual campsite, i.e. more than one firering. In other instances, a large area that was interpreted as homogeneous and not containing potential sites was found actually to contain a few firerings. In the above cases the accuracy figure is artificially

Table 24. Classification of sites relating to aerial photograph identification for trip three in Spanish Peaks Primitive Area.

Classification	Number of Sites
Actual Campsites (evidence of previous use by on-site inspection)	30
Sites identified from aerial photographs	17
Actual	8
Potential	7
Unsuitable	2
Actual campsites not identified from aerial photographs	22

deflated. If the grouping of sites is considered, the percentage of sites correctly identified (15 to 29) is 52 percent. The percentage is still much lower than that achieved in the Bridger Study. The difference is probably attributable to the failure of identifying sites beneath conifer overstory. Greater practice in photo-interpretation within the Spanish Peaks situation before the identification was completed might have produced greater accuracy. Experience was a positive factor for the Bridger situation in that studies' high degree of accuracy.

LOCATION OF SITES

The location of campsites with evidence of previous use is shown in Figure 9. These sites represent the 88 campsites located on the three study trips. Table 25 indicates the number of sites found at a specific locale. It also indicates the maximum number of sites which could be occupied at each locale with no two sites being mutually visible. The maximum number of sites that are not mutually visible amounts to about 70 percent of the 88 sites inspected. The maximum number implies a kind of ideal dispersal of camping parties in any given locale. A likely occurrence might be for a party to camp at a site that would not facilitate this ideal dispersal. In this case, the ability of the locale to support mutual non-visible camps would be reduced from the maximum number presented in Table 25.

Figure 10 shows the location of sites that were identified as heavily impacted. The location of sites that had evidence of horse use is shown in Figure 11.

Figure 9. Location of all sites

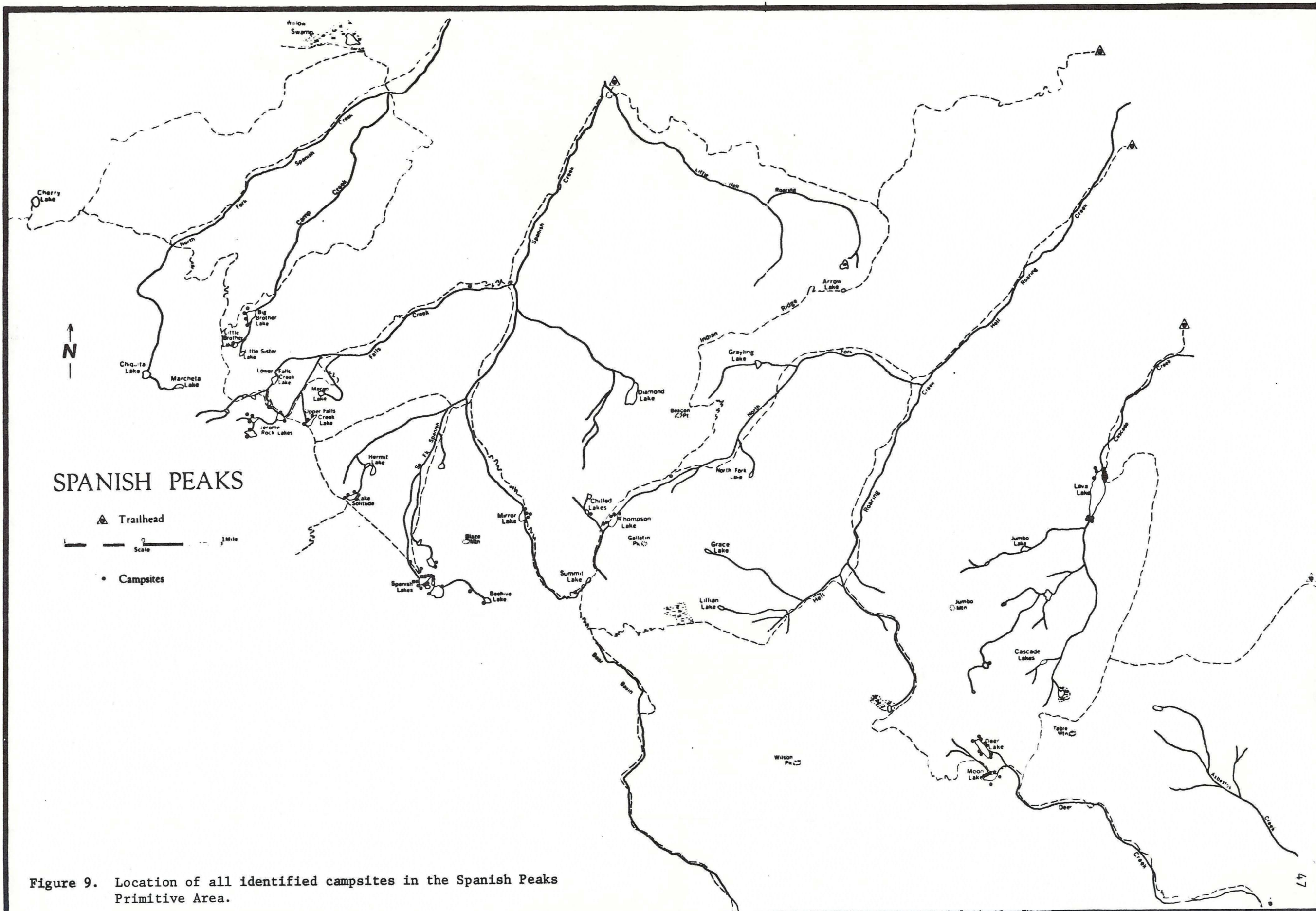
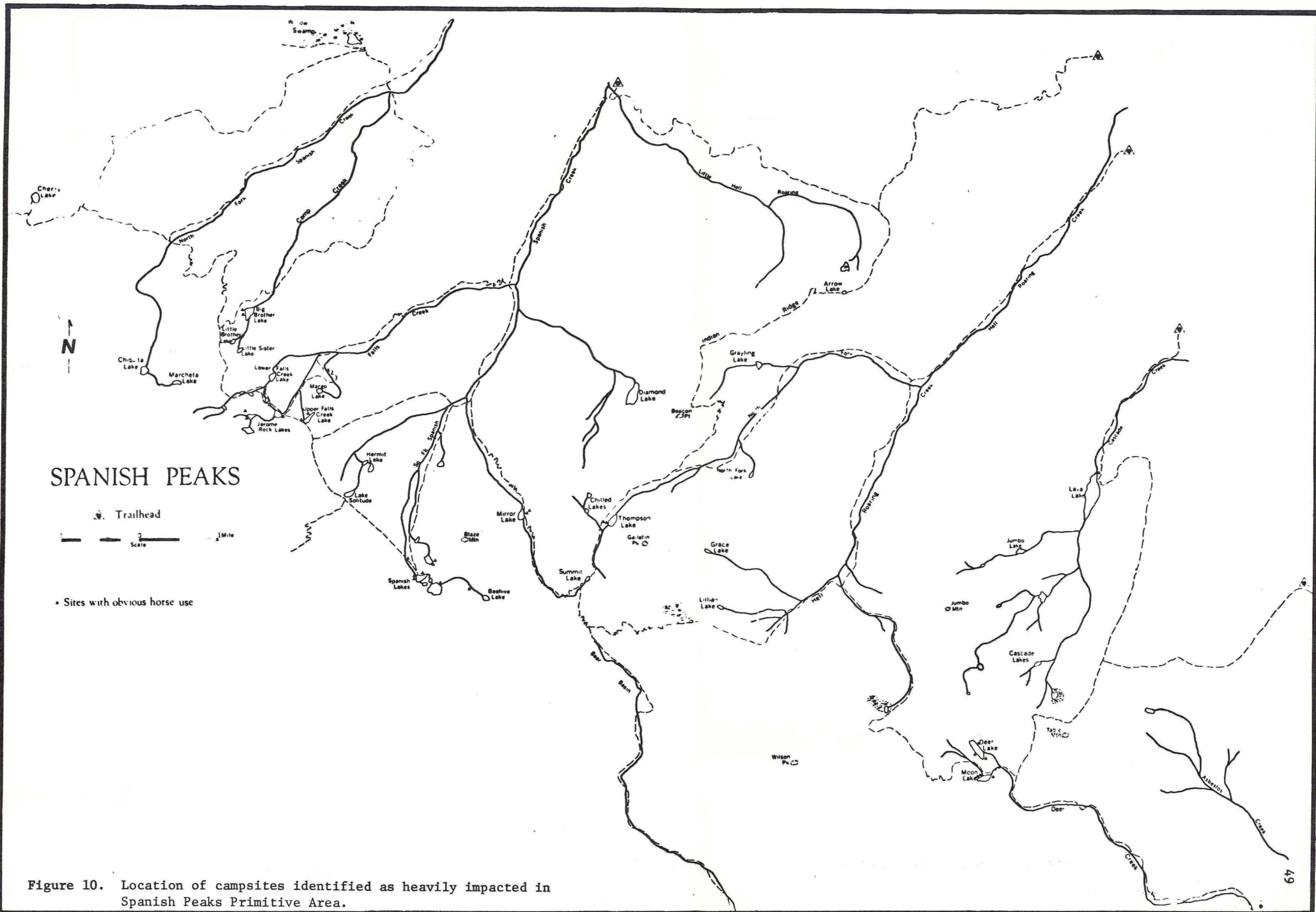


Figure 9. Location of all identified campsites in the Spanish Peaks Primitive Area.

Table 25. Total number of sites and maximum number of sites that are not mutually visible for each locale for Spanish Peaks Primitive Area.

Study group identification	Total number of identified sites	Maximum number of sites that are not mutually visible
North Fork Hell Roaring Creek	1	1
Thompson Lake	6	3
Chilled Lake	1	1
Summit Creek	1	1
Mirror Lake	5	4
Upper Falls Creek Lake	3	3
Jerome Lake	2	2
Pioneer Falls	1	1
Falls-Sp. Creek Junction	1	1
Brother Basin	5	3
Second Lower Fall Creek Lake	1	1
Roseita Lake	3	2
Upper Roseita Lake	2	1
Lake Solitude	5	3
Spanish Lakes	17	10
Beehive Lake & Creek	2	2
Champagne Lake	2	2
Deer Lake	9	5
Moon Lake	6	4
Cascade Lake	1	1
Lava Lake	<u>14</u>	<u>10</u>
TOTAL	88	61



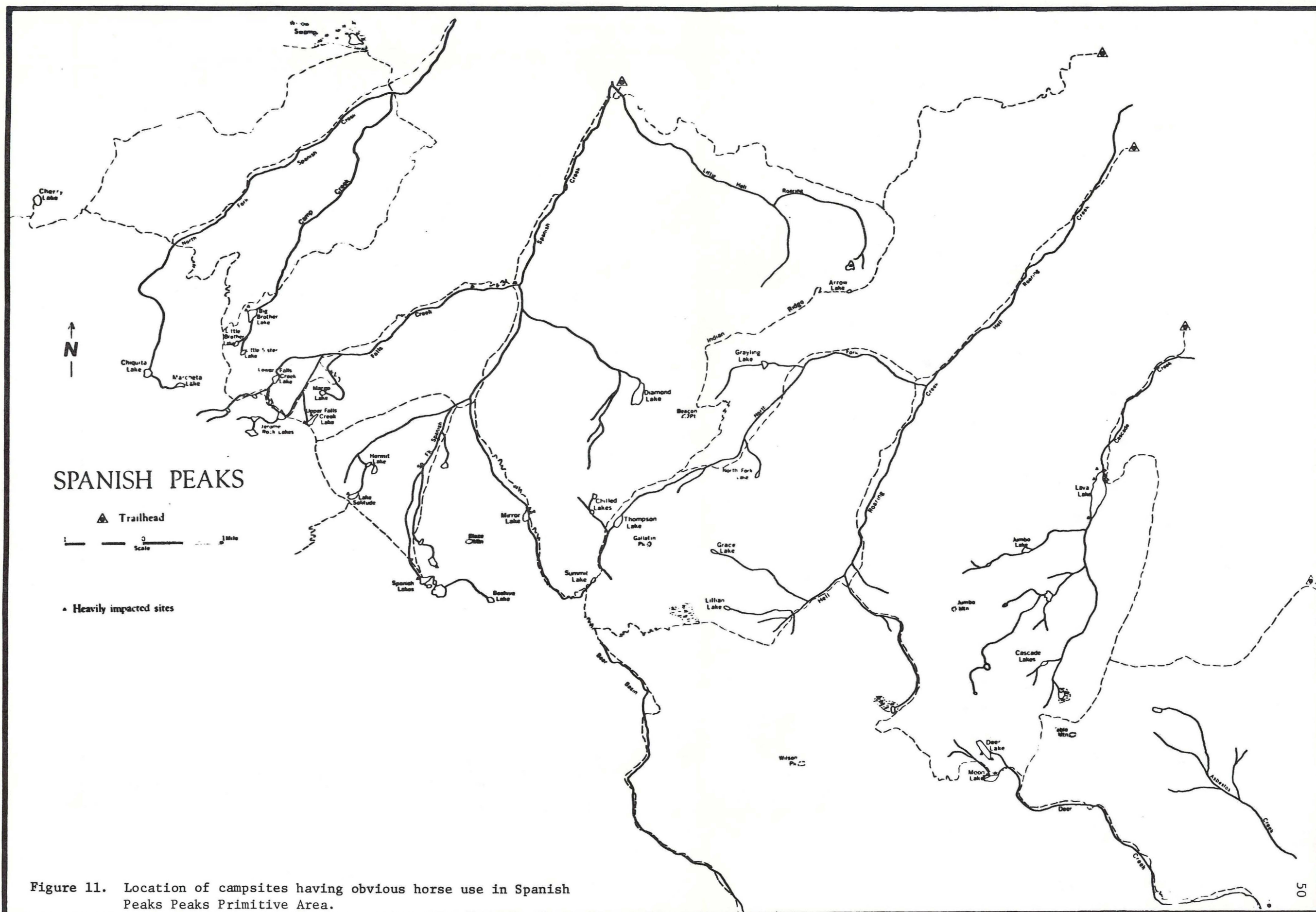


Figure 11. Location of campsites having obvious horse use in Spanish Peaks Peaks Primitive Area.